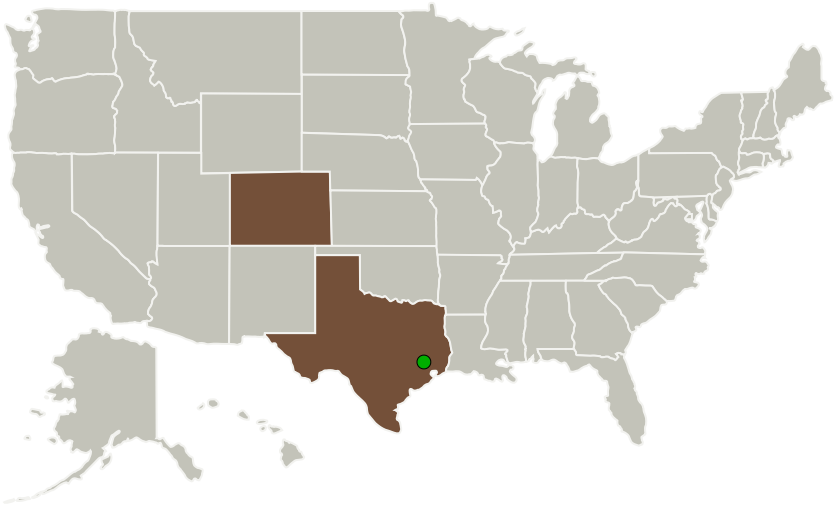
Lightweight, High-Flow, Low Connection-Force, In-Space Cryogenic Propellant Coupling, Phase I

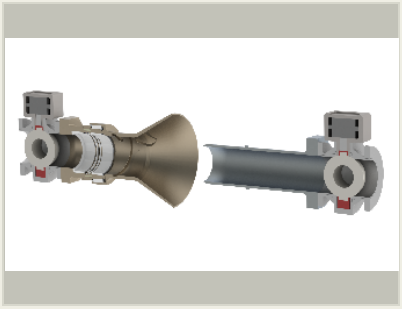
Completed Technology Project (2016 - 2016)

Project Introduction

Three of the key abilities needed for making future NASA and commercial in-space transportation systems more affordable and capable are: a) the ability to 'live off of the land' via in-situ resource utilization (ISRU), b) the ability to reuse in-space transportation hardware, and c) the ability to leverage continuing advancements in lower-cost earth-to-orbit transportation. All of these abilities require the ability to transfer large quantities of cryogenic liquids (Oxygen, Hydrogen, and Methane) between tanks on separate vehicles. In this proposed SBIR research effort, Altius Space Machines proposes the development of a lightweight, high-flow cryogenic propellant coupling to enable such bulk propellant transfers. This coupling incorporates an innovative new cryogenic sealing architecture to enable a coupling with very low insertion/extraction forces, for both robotic and Astronaut-connected cryogenic propellant transfer operations. In Phase I, Altius and its team will focus on developing and testing a proof-of-concept of this innovative new cryogenic sealing architecture, including performing insertion/extraction and leak testing, to compare with a more traditional spring-energized polymer seal concept. Altius will then update the coupling design based on lessons learned-from these tests, raising the TRL from 2 to 3 at the end of Phase I.

Primary U.S. Work Locations and Key Partners





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Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Altius Space Machines, Inc.	Lead Organization	Industry	Broomfield, Colorado
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Colorado	Texas

Project Transitions

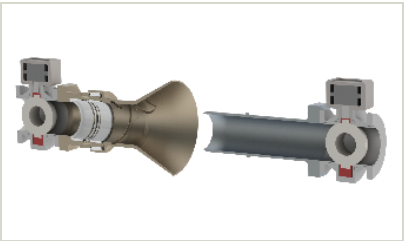
June 2016: Project Start

December 2016: Closed out

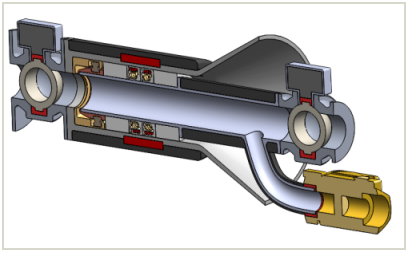
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140456)*

Images



Briefing Chart Image
Lightweight, High-Flow, Low Connection-Force, In-Space Cryogenic Propellant Coupling, Phase I
(https://techport.nasa.gov/image/126500)



Final Summary Chart Image
Lightweight, High-Flow, Low Connection-Force, In-Space Cryogenic Propellant Coupling, Phase I Project Image
(https://techport.nasa.gov/image/126331)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Altius Space Machines, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

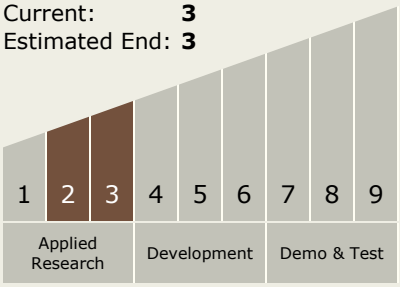
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jonathan A Goff

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System